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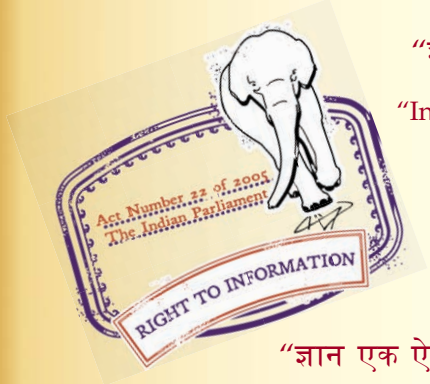


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*Indian Standard*

# SPECIFICATION FOR EQUIPMENT FOR ENVIRONMENTAL TESTS FOR ELECTRONIC AND ELECTRICAL ITEMS

## PART 13 EQUIPMENT FOR CHANGE OF TEMPERATURE TEST

### Section 1 Two Chamber System

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# SPECIFICATION FOR EQUIPMENT FOR ENVIRONMENTAL TESTS FOR ELECTRONIC AND ELECTRICAL ITEMS

## PART 13 EQUIPMENT FOR CHANGE OF TEMPERATURE TEST

## Section 1 Two Chamber System

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# *Indian Standard*

# SPECIFICATION FOR EQUIPMENT FOR ENVIRONMENTAL TESTS FOR ELECTRONIC AND ELECTRICAL ITEMS

## PART 13 EQUIPMENT FOR CHANGE OF TEMPERATURE TEST

### Section 1 Two Chamber System

## 0. FOREWORD

**0.1** This Indian Standard ( Part 13/Sec 1 ) was adopted by the Indian Standards Institution on 27 June 1985, after the draft finalized by the Environmental Testing Procedures Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

**0.2** The object of this standard ( Part 13/Sec 1 ) is primarily to guide the environmental equipment manufacturers with respect to broad specifications for their equipment and to assist the users of such equipment to properly define the requirements in the indent for the equipment. The requirements of the equipment largely depend on the environmental conditions to be simulated or created. It is expected that this standard will harmonize the requirements of the equipment produced by different manufacturers.

**0.3** The change of temperature test may be carried out by one of the three equipment systems ( as suitable ) given below:

a) Two chambers [ for rapid change of temperature ( thermal shock ) test — *see* Sec 1 of IS : 9000 ( Part 14 )-1978* ].

b) One chamber [ for change of temperature ( temperature cycling ) test — *see* Sec 2 of IS : 9000 ( Part 14 )-1978* ], and

c) Two baths [ for rapid change of temperature ( thermal shock ) test — *see* Sec 3 of IS : 9000 ( Part 14 )-1978* ].

**0.3.1** This standard ( Part 13/Sec 1 ) deals with equipment system employing two chambers as well as integral chamber system. The other types of equipment systems are being covered in Sections 2 and 3 of this standard.

*Basic environmental tests for electronic and electrical items: Part 14 Change of temperature.

**0.4** Certain requirements have been specified in a general form in view of practical difficulties in defining such requirements quantitatively. It is presumed that with the experience gained, more precise requirements will be laid down for such equipment.

**0.5** An overall performance assessment of the complete equipment for a short duration has been included although it may be realised that it may not be entirely sufficient. This will at least ensure the functional performance and operatability of the equipment. Many of the constructional requirements specified can be checked through visual examination.

**0.6** In view of the subjective nature of some of the requirements, sufficient care shall be taken in using the standard.

**0.7** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## 1. SCOPE

**1.1** This standard ( Part 13/Sec 1 ) lays down guiding requirements for the design and manufacture of chamber for conducting the change of temperature [ rapid change of temperature ( thermal shock ) ] tests in accordance with Sec 1 of IS : 9000 ( Part 14 )-1978†.

## 2. TERMINOLOGY

**2.1** For the purpose of this standard, the definitions and explanation of terms given in IS : 9000 ( Part 1 )-1977‡ shall apply.

## TWO SEPARATE CHAMBERS

## 3. TESTING CHAMBERS

**3.1 Chamber for Cold Test** — The requirements of the chamber shall be according to IS : 9002 ( Part 1 )-1977§.

**3.2 Chamber for Dry Heat Test** — The requirements of the chamber shall be according to IS : 9002 ( Part 2 )-1977||.

**3.3 Transfer Time** — The transfer time for the test equipment from the cold chamber to the hot chamber shall be as specified in **9.4** of Section 1 of IS : 9000 ( Part 14 )-1978†.

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*Rules for rounding off numerical values ( *revised* ).

†Basic environmental testing procedures for electronic and electrical items: Part 14 Change of temperature.

‡Basic environmental testing procedures for electronic and electrical items: Part 1 General.

§Equipment for environmental tests for electronic and electrical items: Part 1 Chamber for cold test.

||Equipment for environmental tests for electronic and electrical items: Part 2 Chamber for dry heat test.

## INTEGRAL CHAMBER SYSTEM

## 4. CHAMBER CHARACTERISTICS

### 4.1 General

**4.1.1** The chamber shall be basically a three station chamber comprising a low temperature compartment, an ambient compartment open to atmosphere at the centre, and a high temperature compartment.

**4.1.2** A tray or transfer basket shall be provided which shall be capable of moving between the low temperature and high temperature compartments through the ambient compartment, without disturbing much static temperature simulated ( non-metallic basket which is resistant to temperature is preferred ).

**4.1.3** The transfer between high temperature and low temperature compartment shall be achieved either by electrical or pneumatic controls.

### 4.2 Temperature

**4.2.1** The chamber shall be capable of maintaining different temperatures in different compartments as follows:

a) Low temperature compartment : From +40° to —70°C

b) Ambient compartment : Ambient temperature ( open to atmosphere )

c) High temperature compartment : From ambient to +200°C.

**4.2.2** The high temperature and low temperature compartments of the chamber shall be capable of maintaining the set temperature within ±2° and ±3°C respectively under steady state conditions.

NOTE — Where due to the size of the chamber it is not feasible to maintain these tolerances, the tolerance may be widened to ±3° up to 100°C and ±5°C up to 200°C. When this is done, the tolerance used shall be specified in the test report.

**4.2.3** The high temperature and low temperature compartments of the chamber shall be capable of maintaining the specified temperature for at least 96 h continuously.

**4.2.4** Unless otherwise specified, the temperature at any point inside the compartment shall be within ±2°C of the test temperature for that compartment.

**4.2.5** Air circulating fans shall be provided in each compartment to maintain temperature uniformity.

**4.2.6** When the transfer basket with the test items moves into either high or low temperature compartment from ambient compartment, the temperature inside the high or cold temperature compartment shall attain the specified value after a time of not more than 2 min.

**4.3 Dwell Time** — Timers shall be provided for controlling the dwell time of the transfer tray in low temperature, high temperature and ambient compartments. The dwell times in each compartment shall be controllable from 5 minutes to 3 hours.

**4.4 Transfer Time** — The time taken for automatic transfer of basket or tray between any two adjacent compartments shall be less than 10 s or as specified.

**4.5 Thermal Load** — The high and low temperature compartments shall be capable of handling specified thermal loads.

## 5. CONSTRUCTION, WORKMANSHIP AND FINISH

### 5.1 General

**5.1.1** The chamber shall be fabricated preferably with cold rolled steel of sufficient thickness to provide necessary mechanical strength. Corners and seams of the interior liners are to be ac welded as to allow for expansion and contraction under all temperature changes to prevent distortion and damage.

**5.1.2** The materials used for construction of interior walls of the chamber shall be of non-corrosive highly polished stainless steel. A suitable drain shall be provided for the high temperature and low temperature compartments.

**5.2 Dimensions** — The *preferred* sizes shall be selected from the following.

**5.2.1** *Transfer Basket* — 250 × 250 × 250 mm.

**5.2.2** *Chamber* — 0·5, 1, 2·5 $m^3$.

### 5.3 Insulation

**5.3.1** Sufficient glass wool or fibreglass insulation shall be given in between outer and inner walls to prevent deterioration and loss of heating and cooling effects.

**5.3.2** The transfer basket shall have suitable insulating layers to prevent leakage of heat from the chamber through the periphery of the tray.

**5.4 Refrigeration System** — The refrigeration system shall be a mechanical refrigeration system with air cooled or water cooled two stage cascade compressors using Freon refrigerant. If necessary, booster cooling using liquid nitrogen ( $N_2$ ) or liquid carbon dioxide ( $CO_2$ ) may be used.

A suitable hot gas defrost facility should be provided.

**5.5 Heating System** — The heating system shall have heaters shielded from the test specimen to eliminate direct radiation. If necessary, additional booster heating shall be provided for restoration of temperature within the stipulated time.

**5.6 Front Doors and Windows**

**5.6.1** Suitable front doors with door locks shall be provided for the high temperature and low temperature compartments. The doors shall have at least two pane glass windows of specified dimensions.

**5.6.2** Suitable grilled door shall be provided for the ambient compartment.

**5.6.3** A microswitch shall be provided to each door to switch off the fan when the door is opened.

**5.6.4** The glass windows of the low temperature compartment door shall have suitable heating pattern to prevent condensation of moisture on the window. Low wattage heater may be incorporated to remove the condensation of moisture.

**5.6.5** Suitable arrangements shall be made to prevent the freezing on the perimeter of the opening of the low temperature cabinet.

**5.7 Interior Light** — Provision shall be made for illuminating the workspace by incandescent lamps. Porcelain holders shall be used for incandescent lamps.

**5.8 Handling Facilities**

**5.8.1** Suitable swivel castors shall be provided for the easy movement of the chamber with locking arrangements of the wheels.

**5.8.2** Eye bolts shall be provided on the top of the chamber for lifting during transportation or installation.

**5.9 Workmanship** — Workmanship shall be of good current engineering practice

**5.10 Finish**

**5.10.1** All handles and hinges used shall be nickel or chromium plated.

**5.10.2** The external and internal finish of the chamber shall be done so as to ensure protection against corrosion and other similar effects.

**5.11 Miscellaneous** — All electronic, electrical, mechanical and electromechanical parts should conform to relevant Indian Standard, wherever available.

## 6. INSTRUMENT CONSOLE

**6.1** An instrument console consisting of required instruments shall be fitted to the chamber for easy operation. This instrument console shall include the following:

a) Indicating panel consisting of mains on-off switch, mains-on indicator lamp, on-off switch and indicating lamps for refrigeration and heating circuits, manual-automatic control switches;

b) Adjustable automatic timers to indicate the dwell times;

c) Solid state electronic controllers and temperature indicators;

d) Programmable cycle counter to indicate the number of hot and cold cycles;

e) An indicator lamp to show that the programmed cycles have been completed and that the complete system is shut down;

f) A two channel strip chart temperature recorder for recording high temperature and low temperature compartments temperatures; and

g) Safety cut-out for high temperature.

**6.2** A programmable microprocessor controlled temperature controller, which can combine most of the above functions, shall be preferable.

## 7. POWER SUPPLY REQUIREMENTS

**7.1** The equipment shall be capable of operating from an ac supply of 50 Hz either from single phase 240 V $\pm$ 10 percent or three phase 415 V $\pm$ 10 percent the total power supply input shall be declared by the manufacturer.

## 8. SAFETY

**8.1** Adequate electrical safety arrangements shall be incorporated in the chamber design to avoid electric shock to personnel and damage to the chamber.

**8.2** The safety precautions shall be as follows:

a) Protection against supply voltage variation;

b) Safety cut-outs for high temperature/low temperature;

c) Safety interlock to prevent basket transfer when chamber door is open;

d) Adequate heat/electrical insulation at control panel;

e) Door lock safety;

f) Provision for interlocking of fan with heater circuit;

g) Safety alarm ( visual and/or audio ), where required; and

h) Protection against single phasing as well as for phase reversal.

## 9. MARKING

**9.1** The equipment shall be marked with the following information:

a) Manufacturer's name and trade-mark;

b) Working volume, tray size and range of operating conditions; and

c) Any other additional marking, as required.

**9.1.1** The equipment may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution ( Certification Marks ) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

## 10. TESTS

**10.1** The chamber shall be subjected to the following tests:

a) Visual examination and inspection; and

b) Performance.

**10.2** The chamber shall be subjected to performance run at specified temperatures for a minimum period of 96 h.

## 11. INSTRUCTION MANUAL

**11.1** Each chamber shall be supplied with instruction manual which shall contain the following:

a) Operating instructions,

b) Maintenance and service instructions,

c) Schematic diagrams and actual circuit diagrams,

d) List of components with performance data, and

e) List of spare parts.

## 12. INFORMATION TO BE FURNISHED BY THE INDENTOR

**12.1** The following information shall be furnished by the indentor:

a) Temperature range of the chamber ( *see* **4.2** );
b) Dimensions of tray or transfer basket ( *see* **5.2.1** );
c) Thermal loads for high temperature and low temperature compartments ( *see* **4.5** );
d) External and internal finish ( *see* **5.10** );
e) Location of the place;
f) Type of chamber whether vertical or horizontal ( *see* **4.1.1** ); and
g) Automatic test programming, if required ( *see* **6.2** ).

(*Continued from page* 2 )

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# INTERNATIONAL SYSTEM OF UNITS ( SI UNITS )

**Base Units**

| Quantity | Unit | Symbol |
|---|---|---|
| Length | metre | m |
| Mass | kilogram | kg |
| Time | second | s |
| **Electric current** | ampere | **A** |
| Thermodynamic temperature | kelvin | K |
| Luminous intensity | candela | cd |
| Amount of substance | mole | mol |

**Supplementary Units**

| Quantity | Unit | Symbol |
|---|---|---|
| Plane angle | radian | rad |
| Solid angle | steradian | sr |

**Derived Units**

| Quantity | Unit | Symbol | Definition |
|---|---|---|---|
| Force | newton | N | 1 N = 1 kg.m/s$^2$ |
| Energy | joule | J | 1 J = 1 N.m |
| Power | watt | W | 1 W = 1 J/s |
| Flux | weber | Wb | 1 Wb = 1 V.s |
| Flux density | tesla | T | 1 T = 1 Wb/m$^2$ |
| Frequency | hertz | Hz | 1 Hz = 1 c/s (s$^{-1}$ |
| Electric conductance | siemens | S | 1 S = 1 A/V |
| Electromotive force | volt | V | 1 V = 1 W/A |
| Pressure, stress | pascal | Pa | 1 Pa = 1 N/m$^2$ |